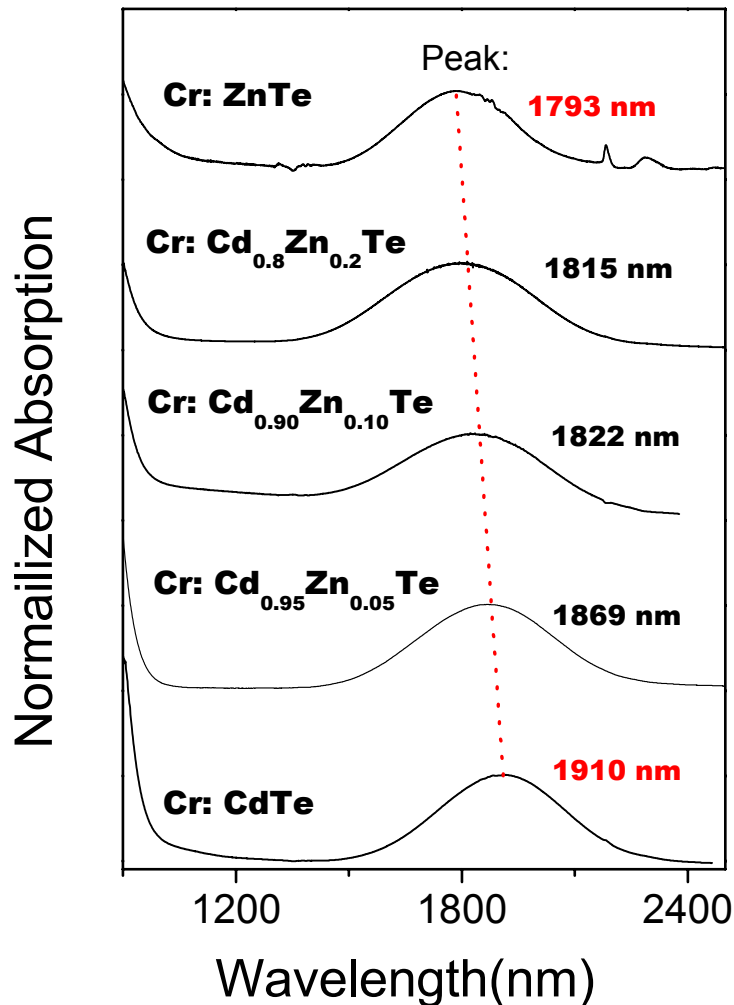
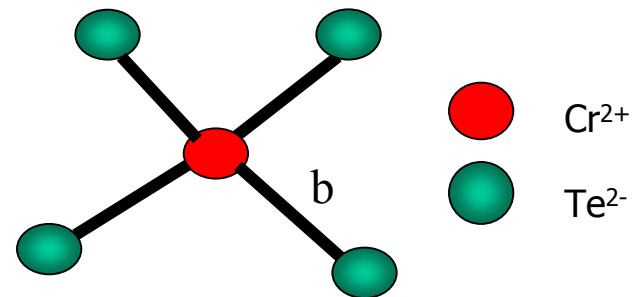


# Crystal-field Engineering of IR Materials for Optoelectronic Applications



Demonstration of compositional engineered infrared absorbing material using Cr: CdZnTe.

The peak IR absorption can be adjusted continuously between 1793 and 1910 nm for wavelengths tailored applications as passive Q-switches and solid-state lasers.



Tetrahedral  $\text{Cr}^{2+}$  site

b: bond-length

Cd-Te: 2.81Å and Zn-Te: 2.63Å;

**“Evaluation of Cr doped Cadmium Chalcogenides for mid-infrared laser applications”, DMR 9733062,  
Hampton University, P.I. U. Hommerich**

Infrared lasers operating at wavelengths between 2000nm and 5000nm of great current interest for applications in laser remote sensing, laser surgery, and fundamental science. Recently, a new class of infrared lasers has been developed at Hampton University (in collaboration with Brimrose Corporation of America) based on Cr<sup>2+</sup> doped Cadmium Chalcogenides. Under the support of this NSF award, lasing has been demonstrated from Cr: CdTe and Cr: CdMnTe.

In an effort to explore other ternary host materials for Cr<sup>2+</sup> ions, Cr doped CdZnTe was investigated. It was observed that the optical properties are highly sensitive to the Zn content in Cr: CdZnTe. With increasing Zn content, the absorption shifted by more than 100 nm, relative to CdTe. The effect can be explained by the modification of the local bond-length (*b*) between Cr<sup>2+</sup> ions and the Te<sup>2-</sup> neighbors. The crystal-field strength experienced by Cr<sup>2+</sup> increases with decreasing bond-length. Therefore, the absorption shifts to shorter wavelength with increasing Zn content in CdZnTe.

The results on Cr: CdZnTe indicate the possibility to engineer the optical properties of Cr<sup>2+</sup> based laser materials for wavelength tailored applications (e.g. solid-state lasers, passive Q-switches).

# Education & Outreach Activities



NSF supports an international and diverse research group at Hampton University.

Dr. U. Hommerich (P.I. of this project) received his graduate education in Germany, and is now an Associate Professor in the Dept. of Physics.

Dr. R. T. Shah is a visiting Research Scientist from India.

Althea Bluiett is an African-American woman who will finish her Ph.D. degree in Physics by the end of 2002.

Ei Ei Nyein is a second year graduate student from Burma.



As part of his NSF Early Faculty Career Award, Dr. Hommerich initiated a new seminar for physics students focusing on Professional & Career Development.